

REMARKS

Claims 1 and 54 have been amended. Claims 78-82 have been added. Therefore, claims 1-6, 8-28, 54-59, and 61-82 are pending in the application. Reconsideration and withdrawal of all outstanding rejections are respectfully requested in light of the foregoing amendments and the following remarks.

Claims 1-2, 4-5, 7, 9, 11-14, 16, 18-20, and 22-24 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Merrill et al. (US 2005/0087829). This rejection is respectfully traversed.

The Office Action mailed November 23, 2005 posits that the claim limitation “adjacent” does not require “touching at some point,” but rather, requires only close proximity. Therefore, the Office Action reasoned that the implant regions 41, 46, and 51 (FIG. 8) in Merrill, which are spaced physically apart could “be interpreted as being ‘adjacent to’ one another.” Office Action, at 12-13.

Claim 1 has been amended to clarify the location of the portions of the photodiode to overcome this rejection. Specifically, claim 1 has been amended to recite, *inter alia*, a pixel structure comprising “a semiconductor substrate of a first conductivity type. . . ; a gate. . . ; and a photodiode. . . including an implant region of a second conductivity type a first portion of said implant region having a lower boundary in said substrate and extending further towards a region of said substrate beneath said gate than a second portion of said implant region extends towards said region beneath said gate, wherein said second portion is adjacent to and substantially underneath said first portion such that said lower boundary of said first portion forms an upper boundary for at least a part of said second portion.”

Merrill does not teach or suggest a photodiode including “an implant region of a second conductivity type” and having first and second portions “wherein said second portion is adjacent to and substantially underneath said first portion such that said lower boundary of said first portion forms an upper boundary for at least a part of said second portion.” For at least these reasons, independent claim 1 is allowable. Claims 2, 4-5, 7, 9, 11-14, 16, 18-20, and 22-24 depend from claim 1 and contain every limitation recited therein. Each of these claims is also allowable for at least these reasons and for the unique combination of elements recited therein. Withdrawal of the rejection is requested.

Claims 1, 4, 5, 7, and 23-24 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Shim (US 2002/0175355). This rejection is respectfully traversed.

The Office Action mailed November 23, 2005 maintained this rejection because the claim phrase “‘a portion of which’ does not clearly indicate” whether it is modifying the photodiode or the implant region. Office Action, at 14. Therefore, the Office Action argued, the implant regions of varying conductivity types taught by Shim may teach the claimed invention. Applicants disagree with this assertion, but have amended independent claim 1 to remove any ambiguity. Specifically, claim 1 has been amended to recite “a photodiode within said substrate, said photodiode including an implant region of a second conductivity type, a first portion of said implant region having a lower boundary in said substrate and extending further towards a region of said substrate beneath said gate than a second portion of said implant region extends.” Thus, the implant region of the present invention includes a first and second portion, both of which must be “a second conductivity type.”

Shim, which discloses an n-type implant region 32 in a p-type substrate 30 and a p-type implant region 37 does not teach or suggest the claimed “implant region of a

second conductivity type, a first portion of said implant region having a lower boundary in said substrate and extending further towards a region of said substrate beneath said gate than a second portion of said implant region extends.” For at least these reasons, independent claim 1 and claims 4, 5, 7, and 23-24, dependent therefrom, should be allowed, and withdrawal of the rejection is requested.

Claims 1-2, 4-5, 7, 9, 11, 15, and 22-26 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Nakamura et al. (US 2004/0108502). This rejection is respectfully traversed.

Similar to the arguments above, the Office Action mailed November 23, 2005 maintained this rejection based on perceived ambiguities in claim 1 that could be interpreted broadly to cover the photodiode shown in Nakamura including three portions (36, 40 and 50 in FIG 11C). Office Action, at 15.

This rejection is obviated in view of the foregoing amendments. Specifically, claim 1 has been amended to recite a photodiode including an “implant region of a second conductivity type, a first portion of said implant region having a lower boundary in said substrate and extending further towards a region of said substrate beneath said gate than a second portion of said implant region extends.” Nakamura does not teach or suggest this unique combination of elements, and claim 1 is therefore allowable. Claims 2, 4-5, 7, 9, 11, 15, and 22-26 each depend from claim 1 and contain all of the limitations recited therein and are also submitted to be allowable. Withdrawal of the rejection is therefore requested.

Claims 3 and 27-28 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Nakamura et al. This rejection is respectfully traversed. Claims 3 and 27-28 depend from claim 1 and are patentable at least for the reasons mentioned above.

Applicants respectfully request that the 35 U.S.C. § 103(a) rejection of claims 3 and 27-28 be withdrawn.

Claims 9, 11, 13, and 15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Shim in view of Lee et al. (US 2003/0030083). This rejection is respectfully traversed. Claims 9, 11, 13, and 15 depend from claim 1 and are patentable at least for the reasons mentioned above. Applicants respectfully request that the 35 U.S.C. § 103(a) rejection of claims 9, 11, 13, and 15 be withdrawn.

Claims 54-58, 60, 62, 64, 66, 68, and 74-77 stand rejected under 35 U.S.C. § 102(e) as being unpatentable over Nakamura et al. in view of Nagata et al. (US 6,407,417). In light of the text of the rejection, Applicant presumes this is meant to be a 35 U.S.C. § 103(a) rejection and will be treated as such. This rejection is respectfully traversed. In order to establish a *prima facie* case of obviousness “the prior art reference (or references when combined) must teach or suggest all the claim limitations.” M.P.E.P. §2142. Neither Nakamura et al. nor Nagata et al., even when considered in combination, teach or suggest all limitations of independent claim 54.

Claim 54, as amended, recites, *inter alia*, pixel imager system, comprising “a semiconductor substrate of a first conductivity type ...; a gate ...; and a photodiode within said substrate, said photodiode including an implant region of a second conductivity type, a first portion of which extends further towards a region of said substrate beneath said gate than a second portion of said implant region, wherein said second portion is substantially underneath said first portion such that at least a portion of a lower boundary of said first portion forms an upper boundary for said second portion.” (Emphasis added.) As discussed above regarding the patentability of claim 1, Nakamura et al. does not teach or suggest this limitation. Nakamura et al. teaches signal accumulating regions 40, 50 which are horizontally adjacent to one another in a

substrate 32. There is no second portion substantially beneath a first portion. Nor is Nagata et al. cited for this limitation. Thus, Nagata et al. does not remedy the deficiency of Nakamura et al.

Accordingly, Nakamura et al. and Nagata et al. do not teach or suggest all of the limitations of claim 54. Claim 54 and dependent claims 55-58, 60, 62, 64, 66, 68, and 74-77 are, therefore, not obvious over the cited references. Applicants respectfully request that the 35 U.S.C. § 103(a) rejection of claims 54-58, 60, 62, 64, 66, 68, and 74-77 be withdrawn.

Claims 6, 8, 10, 17, 21, 59, 63, 65, 67, and 69-74 stand objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claims and any intervening claims. Claims 6, 8, 10, 17, 21, 59, 63, 65, 67, and 69-74 depend, respectively, directly, or indirectly from independent claims 1 and 54, and are allowable for at least the reasons set forth above.

In addition, new independent claim 78 recites the subject matter of claim 9 that was previously acknowledged by the Examiner as allowable subject matter. See Office Action mailed June 14, 2005, at 12. Therefore, claims 78 and 79-82, which depend from claim 78, are submitted to be allowable.

In view of the above amendment, Applicants believe the pending application is in condition for immediate allowance. Favorable action on claims 1-6, 8-28, 54-59, and 61-82 is solicited.

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